

## **PROPOSED MISSION AND FUNCTION STATEMENT**

### **OFFICE OF SCIENCE**

### **OFFICE OF BIOLOGICAL AND ENVIRONMENTAL RESEARCH**

#### MISSION

The Biological and Environmental Research (BER) program develops and delivers new knowledge that promotes national security through biotechnology solutions for clean energy, environmental cleanup, and carbon sequestration; climate change research; and new resources and tools to the medical community. BER supports these vital national missions through competitive and peer-reviewed research at National Laboratories, universities, and private institutions. In addition, BER develops and delivers the knowledge needed to support the President's National Energy Plan and provides the science base in support of the Energy Policy Act of 1992.

#### Program Objectives

- Develop a new basis for biotechnology solutions for clean energy, carbon sequestration, and environmental cleanup by characterizing the multiprotein complexes that carry out biology in cells, the regulatory circuits that control those complexes, and by determining how microbial communities work as a system.
- Determine the sensitivity of climate to different concentrations of greenhouse gases and aerosols in the atmosphere and the potential consequences of climate change associated with these levels by resolving or reducing key uncertainties in model predictions of both climate change that would result from each level and the associated consequences.
- Develop the basic understanding to enable and advance environmental cleanup methodologies needed to reduce risks, costs, and schedules associated with the cleanup of the US nuclear weapons complex.
- Develop a new scientific underpinning for radiation risk regulatory policy.
- Provide new resources and tools to the medical community for state-of-the-art medical imaging for better diagnosis and prevention of disease.
- Provide user facilities and infrastructure to enable world class research in the biological and environmental sciences and manage all BER user facility operations and construction to the highest standards of overall performance, using merit evaluation with independent peer review.

#### ORGANIZATIONAL STRUCTURE

1. Life Sciences Division
2. Medical Sciences Division
3. Climate Change Research Division
4. Environmental Remediation Sciences Division

#### FUNCTIONS

##### Life Sciences Division

1. Develops, as an integral part of the International Human Genome Project, the resources, tools, and technologies needed to analyze and interpret DNA sequence data from entire organisms, determines the function of the genes identified from DNA sequencing, and studies the ethical, legal, and social implications (ELSI) of information and data resulting from the Human Genome Project.
2. Operates Life Sciences user facilities including the structural biology user facilities to provide the data

to understand protein structure; the Joint Genome Institute's (JGI) high throughput DNA sequencing facility, the Production Genomics Facility to provide a high throughput DNA sequencing user resource to meet DNA sequencing needs of the scientific community; and the Center for Comparative Genomics (mouse facility) to provide animal models for understanding human gene function as part of the Human Genome project.

3. Characterizes the multiprotein complexes that carry out biology in cells, the regulatory circuits that control those complexes, and determines how microbial communities work as a system, information that will enable us to (1) predict the responses of single celled and multi-cellular organisms to their environments (2) use this predictive capability to address DOE needs in energy and the environment.
4. Supports research on low dose and low dose-rate radiation to provide a better scientific basis for the development of future radiation risk policy needed to achieve acceptable levels of human health protection from low levels of ionizing radiation.
5. Assures that all research involving human subjects conducted at DOE facilities or supported by DOE is in compliance with 10 CFR part 745, Federal Policy for the Protection of Human Subjects; Notices and Rules: maintains a human subjects research database; organizes educational meetings for DOE investigators and managers; establishes a compliance and audit system; publishes resource materials; and conducts workshops and meetings.

#### Medical Sciences Division

1. Develops novel synthesis methods and new radiotracers for clinical medicine. Fundamental research is conducted on radiopharmaceutical design and synthesis using concepts from radiochemistry, genomics, structural biology and computational biology. Radiotracers are synthesized using sophisticated combinatorial chemistry that allow cell targeting of specific molecules critical in the function of cells and organs.
2. Develops more sensitive instruments and novel approaches for advanced medical imaging needed for diagnosis and monitoring of disease. New tools will enable the real-time imaging of gene expression (monitoring genes turning on and off) in real time in animals and eventually in humans. The research is concerned with the development of novel tools to image receptor-ligand, antibody-antigen and other molecular interactions of potential medical utility, particularly using positron emission tomography (PET).
3. Capitalizes on unique resources and expertise at the National Laboratories in engineering, biology, chemistry, physics, and computer science for technological advances related to human health. Research will lead to advances such as the construction of an artificial retina, medical imaging of moving subjects, and the use of technologies from fields such as astronomy to improve the sensitivity of biological imaging. This research is highly complementary to and coordinated with clinical research at the National Institutes of Health (NIH) and to basic research in the NIH intramural and extramural programs.
4. Develops and supports user facilities for the Nation's structural biologists; combines computer science, structural biology, and genome research for analyses and predictions of gene function from the individual gene to the genomic level; and develops new technologies and methodologies to understand the dynamic processes of protein-protein interactions that are unique to living organisms.
5. Supports fundamental research to develop new sensor instrumentation for cleanup efforts and new imaging instrumentation having broad application in the life and medical sciences

#### Climate Change Research Division

1. Supports research to understand the radiation balance from the surface of the Earth to the top of the atmosphere and how changes in this balance, due to increases in the concentration of greenhouse gases in the atmosphere, may alter the climate. Includes research and facilities of the Atmospheric Radiation Measurement (ARM) program needed to resolve the greatest scientific uncertainty in climate change prediction – the role of clouds and solar radiation.
2. Develops advanced, fully coupled climate models and uses massively parallel supercomputers to simulate and predict climate and climate change, including evaluating uncertainties in climate models due to changes in atmospheric levels of greenhouse gases on decade-to-century time scales.

3. Supports basic research to acquire the data needed to understand atmospheric processes that control the transport, transformation, and fate of energy-related chemicals and particulate matter emitted to the atmosphere. Research studies processes related to new air quality standards for tropospheric ozone and particulate matter and on the relationship between air quality and climate change.
4. Develops the new knowledge to determine the movement of carbon on a global scale from natural and anthropogenic emissions to ultimate sinks in the terrestrial biosphere and the oceans. Experimental and modeling efforts address the net exchange of carbon between major types of terrestrial ecosystems and the atmosphere. This research includes DOE's contribution to the Climate Change Research Initiative, an interagency effort on specific areas of climate change research in which substantial progress in understanding and modeling is expected over the next five years.
5. Supports basic research to understand the biosphere's natural processes to enhance the sequestration of atmospheric carbon dioxide in terrestrial and marine ecosystems. It also develops the understanding needed to assess potential environmental implications of purposeful enhancement and/or disposal of carbon in the terrestrial biosphere and at the surface or in the deep ocean.
6. Develops and supports experimental and modeling studies to understand and simulate the effects of climate and atmospheric changes on the biological structure and functioning of terrestrial ecosystems. It also seeks to identify potential feedback effects of ecosystem responses on climate and atmospheric composition. The research emphasizes major field studies of intact ecosystems using experimental manipulations.
7. Supports research to improve methods and models to assess the economic and societal costs and benefits of both human-induced climate change and possible response options/strategies for mitigating or adapting to climate change. It supports the archiving and analysis of global change data, making it available for use by the broader global change research community.
8. Operates climate research user facilities including the Atmospheric Radiation Measurement (ARM) Cloud and Radiation Testbed facilities that provide data on solar and thermal infrared radiative fluxes at Earth's surface and all of the atmospheric quantities affecting those fluxes, and experimental Free-Air Carbon Dioxide Enrichment (FACE) facilities for studying the effects of changes in atmospheric composition, especially increases in carbon dioxide and ozone concentrations and climatic changes on terrestrial ecosystems.

#### Environmental Remediation Sciences Division

1. Supports research to determine how and where bioremediation may be applicable as a reliable, efficient, and cost-effective technique for cleaning up or containing metals and radionuclides in contaminated subsurface environments.
2. Operates the Environmental Molecular Sciences Laboratory (EMSL), a national user facility that provides scientists with a suite of unique and cutting-edge capabilities and tools needed to develop the scientific underpinning for safe and cost-effective environmental remediation methods and technologies. Its capabilities also support other DOE missions such as national security, functional genomics, and structural biology.
3. Supports basic research to characterize the geologic, chemical, and physical properties that affect the rate and effectiveness of a variety of environmental remediation and waste-stream cleanup methods, including bioremediation.
4. Conducts, in close cooperation with the Office of Environmental Management, merit reviewed basic research that supports and advances the Department's environmental clean up effort.

April 2002